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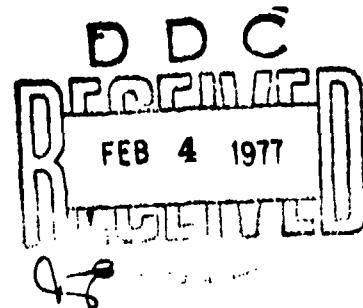
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30 September 1976

Naval Aerospace Medical Research Laboratory  
Naval Air Station  
Pensacola, Florida 32508

## FOREWORD

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Rita S. McAllister

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\*Denotes studies performed jointly with and supported by the United States Army Aeromedical Research Laboratory, Fort Rucker, Alabama.

Work Unit

MF51.524.004-2011.1  
NAMRL-1224  
(AD A023499)

Accuracy and Latency Scores as Measures of Spatial Information Processing 2/27/76

Dennis E. Egan

**Abstract:**

The processing of visually presented spatial information is a critical component of the activities performed by pilots and aircrewmen. In particular, Radar Intercept Officers and Air Control Officers must make rapid and accurate spatial judgments. It is likely that variation in the ability to process spatial information accounts for some of the undesirable variations in the performance of these jobs. Previous research using conventional or "accuracy" scoring for paper-and-pencil tests has identified two "spatial factors" (Spatial Orientation and Spatial Visualization) that are valid predictors of success in pilot and navigator training programs. Recent experimental work has used the latency of response to spatial problems to analyze the mental processing of spatial information. The present studies combine these approaches by investigating both accuracy and latency scores as measures of the ability to process spatial information. Spatial test items were redesigned to be suitable for collecting latency as well as accuracy scores. In two experiments four new spatial tests were administered to groups of U.S. Navy pilot and flight officer candidates. The psychometric properties of latency and accuracy scores from those tests were determined. Informal tests of several hypotheses about spatial processing were carried out. Derived methods of spatial processing were proposed and analyzed. Response latency scores are both feasible and desirable for assessing the ability to process spatial information. Latency scores

were highly reliable and correlated across different spatial tests. Accuracy scores were somewhat less reliable, but correlated predictably across tests. Interestingly, latency and accuracy were virtually independent measures. Tentative support was found for a model of Spatial Orientation patterned after theories of concept verification. Spatial Visualization appeared to be a continuous process similar to physically turning an object in space. Measures of spatial processing based on those models correlated in a consistent pattern.

MF51.524.005-7026.3      Orientation-Error Accidents in Regular Army UH-1 Aircraft During Fiscal Year 1971: Relative Incidence and Cost  
USAARL 75-21  
NAMRL-1218  
(AD A014423)

6/11/75

W. Carroll Hixson and Emil Spezia

**Abstract:**

This report is the fifth in a longitudinal series of reports dealing with the magnitude of the pilot disorientation/vertigo accident problem in Regular Army UH-1 helicopter operations. Incidence and cost data presented for fiscal year 1971 include a total of 31 major and minor orientation-error accidents (15 of which were fatal), resulting in 44 fatalities, 52 nonfatal injuries, and a total UH-1 aircraft damage cost of \$6,337,446.

MF51.524.005-7026.4      Major Orientation-Error Accidents in Regular Army UH-1 Aircraft During Fiscal Year 1971: Accident Factors  
USAARL 76-1  
NAMRL-1219  
(AD A017665)

7/7/75

W. Carroll Hixson and Emil Spezia

**Abstract:**

This report is the fifth in a longitudinal series of reports dealing with the pilot disorientation/vertigo problem in Regular Army UH-1

helicopter operations. Individual case history data extracted from the USAAVS master aircraft accident files are presented on major orientation-error accidents that occurred in UH-1 aircraft during fiscal year 1971. Summary data listings involving a variety of operational and pilot-related accident factors are presented for each of the 31 cases. The listings are arranged to distinguish between those factors and events present before takeoff, i.e., the initial conditions associated with a given accident, and those which occurred or were manifested during the actual airborne phase of the accident flight.

MF51.524.005-7027.1  
NAMRL-1217  
(AD A018067)

Pulmonary Function Testing in Military Personnel: A Preliminary Study

5/28/75

Robert Bason and David R. Stoop

**Abstract:**

The military community is made up of a very diverse group of individuals representing a random sample from all walks of life and geographical locations. Although these individuals are supposedly healthy, an increasing number of them are later being diagnosed as having obstructive ventilatory mechanics.

This study is concerned with the pulmonary function results of a supposedly healthy population of naval aviation officer candidates and designated naval aviators at Naval Air Station, Pensacola, Florida.

The data suggest a high incidence of obstructive ventilatory mechanics in a relatively young age group (20-24 years old). Whereas most studies such as this reflect disease statistics in patients already symptomatic, this current investigation reveals a significant percentage (23.5%) of the as yet asymptomatic young age group who have the beginnings of a long-term process.

MF51.524.005-7027.2 Pulmonary Function Testing in 5/17/76  
NAMRL-1227 Aviation Selectees  
(AD A029138)

Robert Bason, Neil R. MacIntyre,  
and David Vick

Abstract: 718 aviation students were divided into four groups, and pulmonary function tests results compared among nonsmokers, former smokers, current smokers, and those with pulmonary symptoms. Cigarette smoking did not have any measurable effect on pulmonary functions. Pulmonary functions for the purpose of establishing norms for this age group according to height are summarized.

MF51.524.015-0012.1 Some Considerations Concerning the 5/28/75  
NAMRL-1216 Use of Magnetron Generators in  
(AD A013329) Microwave Biological Research

Vernon R. Reno

Abstract: A series of measurements was taken to characterize the microwave fields produced for biological studies by traveling-wave-tube and magnetron generators under different operating conditions. Results indicate that the field incident on the animal can differ, depending upon both the generator and the conditions of its operation. These differences may not be apparent if the field is described only in terms of average power.

MF51.524.015-0013.1 The Continuing Medical Surveillance 3/25/76  
NAMRL-1225 of Personnel Exposed to Extremely  
(AD A024668) Low Frequency (ELF) Electromagnetic Fields

William M. Houk

Abstract: The previously reported evaluation of the health of civilians residing or

working near the Wisconsin Extremely Low Frequency (ELF) Test Facility has been continued at the Naval Aerospace Medical Research Laboratory in Pensacola, Florida, in 1974 and 1975. The content of the previous report is reviewed and discussed, especially with respect to the reporting format and results obtained. Seven civilian subjects, five male and two female, five of whom are part of the original group of 24, participated in the continuing surveillance program. One new employee was added to the group in 1974, and one declined to participate in 1975. Since none of the 24 matched control group volunteers was available after 1972, the format adopted for the original program was revised. Additional tests were added to further study lipid and carbohydrate metabolism to reflect the current interest in these parameters. Throughout the entire period of medical surveillance from 1971 to 1975, there was no evidence of any particular disease induction, physiochemical parameter alteration, or aberration of psychological tests attributable to ELF electromagnetic field exposure.

MF51.524.015-0037.1      Behavior and Temperature of Rhesus  
NAMRL-1222                  Monkeys Exposed to Low Level Microwave  
                                Irradiation

1/19/76

John O. de Lorge

Abstract:

Male rhesus monkeys, trained to respond on an auditory vigilance task, were exposed to vertically polarized 2450 MHz microwaves in an anechoic room. Power densities of 4, 16, 32, 42, 52, 62, and 72 mW/cm<sup>2</sup>, and exposure times of 30, 60, and 120 minutes were used. The monkeys performed the vigilance task in a styrofoam restraint chair while irradiated from the front. Body temperature was monitored during exposure at all but the lowest power density. Vigilance performance

was not affected until 72 mW/cm<sup>2</sup> illuminations occurred. Colonic temperature increase appeared to be a logarithmic function of power density from 16 to 72 mW/cm<sup>2</sup>, whereas no such relationship was observed with behavioral indices. The animals showed adaptation to the microwaves in both behavioral and thermal measures, and thermal equilibrium was obtained except at 72 mW/cm<sup>2</sup>.

MR000.01.01.7022.1      Evaluation of the Squirrel Monkey  
NAMRL-1221      (Saimiri sciureus) As an Experimental Animal Model for Dysbaric Osteonecrosis      1/7/76  
(AD AC21287)

James L. Kupper

**Abstract:** In an attempt to develop an animal model for dysbaric osteonecrosis in man, squirrel monkeys were repeatedly exposed to a profile consisting of both hyperbaric and hypobaric pressures. Clinical and subclinical decompression sickness was produced. No clinical, radiologic, or post-mortem evidence of osteonecrosis was discovered during either the 6-month pressure exposure or the 13-month observation period that followed.

M4305.08-3010.1      Development of a Prototype Experimental Plan to Evaluate Stabilized Optical Viewing Devices: II. Inflight Measures of Airsickness Potential      3/8/76  
USAARL 76-15  
NAMRL-1223  
(AD AO25455)

W. Carroll Hixson, Fred E. Guedry, Jr., Joel W. Norman, David D. Glick, and Roger W. Wiley

**Abstract:** Investigators at the Naval Aerospace Medical Research Laboratory and the U.S. Army Aeromedical Research Laboratory conducted a combined field and laboratory study to

evaluate observer performance while using an improved XM-76 stabilized viewing device. Air-to-ground observations were made in a UH-1 aircraft, flying maneuvers modeled in part after a scout helicopter scenario. The experimental protocol was such that visual acuity data were collected under three different observation conditions: with the naked eye, with XM-76 operated in its normal stabilized mode, and with the XM-76 operated in a caged or nonstabilized mode. Measures of selected airsickness symptoms were derived from an onboard flight observer and from postflight questionnaires. The resulting data indicate that the level of airsickness symptoms manifested by the subject group while using the device was higher than the baseline level present when the observation was made without the device. This rise in symptom level was found to be present whether the XM-76 optics were stabilized or nonstabilized. Importantly, no statistically significant difference could be found between the magnitude of the symptoms present when the device was stabilized and the magnitude when caged. In contradistinction to the hypothesis that the stabilization feature of such devices increases the airsickness potential, the general trend of the data showed the opposite effect. A previous report detailed the results of the visual acuity aspects of the project. The present report pertains primarily to the inflight measures of airsickness potential. A third report will describe the results of the laboratory evaluation of airsickness susceptibility of the individual subjects.

NASA T-81D  
NAMRL-1228  
(AD A029370)

Nuclear Emulsion Measurements of the  
Astronauts' Radiation Exposure on the  
Apollo-Soyuz Mission

6/23/76

Hermann J. Schaefer and Jeremiah J. Sullivan

**Abstract:** Ilford G.5 and K.2 emulsions in the astronauts' personnel dosimeter packs furnished quantitative data on the various components of the astronauts' radiation exposure on Apollo-Soyuz. Track and grain counts of the proton population in G.5 and proton under counts in K.2 emulsion indicate a proton dose of 51 millirad and 74 millirem. Tissue disintegration stars including neutrons contribute an additional 4.6 millirad and 38 millirem. HZE particle tracks were evaluated using a reference scale of tracks with known Z and E values available in the literature. Applying a QF of 20 to all LET-values beyond  $1750 \text{ Mev}/(\text{g/cm}^2\text{T})$ , one obtains a dose contribution of 4.3 millirad and 61 millirem from HZE particles. An emulsion sheet of 1.5 square inch area and 100 micron thickness recorded eight terminating HZE particles of  $Z > 10$  and 15 through-shots of high E particles with  $Z > 20$ . This finding is significantly different from all Gemini and Earth-orbital Apollo missions on which terminating heavy particles have never been observed. It indicates the downward extension of the energy spectrum due to the higher orbital inclination of  $52^\circ$  and the correspondingly lower geomagnetic cutoff.

NASA T-43310G  
NAMRL-1220  
(AD A019804)

Nuclear Emulsion Measurements of the  
Astronauts' Radiation Exposures on  
Skylab Missions 2, 3, and 4

12/10/75

Hermann J. Schaefer and Jeremiah J. Sullivan

**Abstract:** On the Skylab missions, Ilford G.5 and K.2 emulsions were flown as part of passive dosimeter packs carried by the astronauts on their wrists. Due to the long mission times, latent image fading and track crowding imposed limitations on a quantitative track and grain count

analysis. Merely for Skylab 2, the complete proton energy spectrum was determined within reasonable error limits. A combined mission dose equivalent of 2,490 millirems from protons, tissue stars, and neutrons was measured on Skylab 2. A stationary emulsion stack, kept in a film vault drawer on the same mission, displayed a highly structured directional distribution of the fluence of low-energy protons (enders) reflecting the local shield distribution.

On the 59 and 84-day missions 3 and 4, G.5 emulsions had to be cut on the microtom to 5-7 microns for microscopic examination. Even so, the short track segments in such thin layers precluded a statistically reliable grain count analysis. However, the K.2 emulsions still allowed accurate proton ender counts without special provisions.

XSB09.ED6.6-E1  
NAMRL-1226  
(AD A029138)

Establishment of Normal Electrocardiographic Values for Rhesus Monkeys (Macaca mulatta) Under Sedated and Unsedated Conditions

4/23/76

James L. Kupper, Matthew J. Kessler,  
and John D. Clayton

Abstract:

In an attempt to establish normal electrocardiographic values for sedated and unsedated rhesus monkeys at this laboratory, electrocardiographic tracings from 57 female and 56 male rhesus monkeys under sedated and unsedated states were examined to determine normal values for the various parameters. The data were statistically analyzed for significant differences between sex groups and sedated versus unsedated monkeys of the same sex. The results are compared with two previous major electrocardiographic studies on unsedated rhesus monkeys.

Monograph

No. 22  
(AD A025970)

Atlas of Nuclear Emulsion Monographs from 5/27/76  
Personnel Dosimeters of Manned Space  
Missions

Hermann J. Schaefer and Jeremiah J. Sullivan

**Abstract:**

A collection of micrographs is presented taken from nuclear emulsions of personnel dosimeter packs carried by the astronauts on near-Earth orbital and lunar missions. It is intended as a pictorial record and illustration of the radiation environment in space and as a supplement to earlier reports and publications of the laboratory in which the emulsion findings have been presented in detail for individual missions. A complete list of those earlier accounts precedes the picture section.

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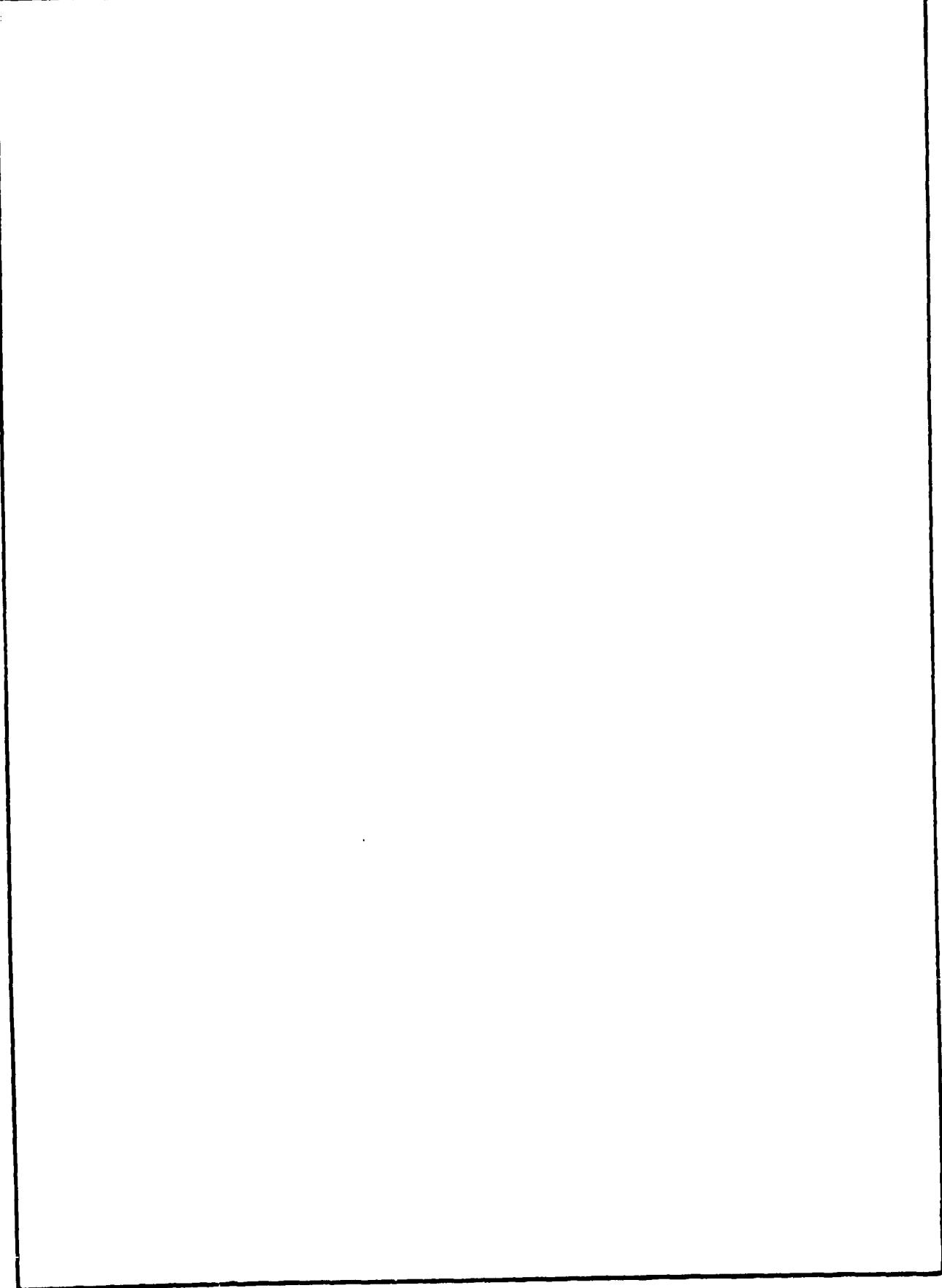
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